

SPIDERS Microgrids for Enhanced Mission Assurance and Renewable Energy Utilization

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SPIDERS MICROGRIDS FOR ENHANCED MISSION ASSURANCE AND RENEWABLE ENERGY UTILIZATION

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The ability of today's warfighter to command, control, deploy, and sustain forces is adversely impacted by a fragile, aging, and fossil fuel dependent electricity grid. This poses a significant threat to national security. The SPIDERS (Smart Power Infrastructure Demonstration for Energy Reliability and Security) is designed to provide a comprehensive secure energy solution using energy surety microgrids (ESMs) and cyber-security of electric grids applying virtual secure enclave networks to SCADA. Smart Grid Technologies will be implemented to secure micro-grid for sustained mission assurance and emergency support. Integration of distributed & variable renewable generation and storage along with intelligent demand-side management will be deployed in concert with redundant back-up power systems to provide seamless, secure power to mission loads in grid connected and grid islanded operation.

The SPIDERS Joint Concept Technology Demonstration (JCTD) will address four critical deficiencies:

1. Inability to protect task critical assets from loss of power due to cyber attack
2. Inability to integrate renewable and other distributed generation electricity to power task critical assets in times of emergency
3. Inability to sustain critical operations during prolonged power outages
4. Inability to manage installation electrical power and consumption efficiently, to reduce petroleum demand, carbon "bootprint," and cost.

Problem Statement

- ▶ The ability of today's warfighter to command, control, deploy, and sustain forces is adversely impacted by a fragile, aging, and fossil fuel dependent electricity grid.
- ▶ This poses a significant threat to military operations as critical mission loads are typically highly dependent on electric power
- ▶ Existing emergency generators are often unreliable, inefficient, and environmentally unfriendly



SPIDERS Approach

- ▶ SPIDERS (Smart Power Infrastructure Demonstration for Energy Reliability and Security) delivers a comprehensive, cyber secure energy solution using energy surety microgrids (ESMs) developed at Sandia National Laboratory



SPIDERS Approach

- ▶ Smart Grid technologies will be implemented to secure micro-grid for sustained mission assurance and emergency support. Integration of distributed & variable renewable generation and storage
- ▶ Intelligent demand-side management will be and coordinated with aggressive renewable energy solutions to significantly reduce environmental impact of mission operations
- ▶ Seamless, secure power to mission loads in grid connected and grid islanded operation.



SPIDERS Approach

The SPIDERS JCTD will address four critical deficiencies:

- 1) Inability to protect task critical assets from loss of power due to cyber attack
- 2) Inability to integrate renewable and other distributed generation electricity to power task critical assets in times of emergency
- 3) Inability to sustain critical operations during prolonged power outages
- 4) Inability to manage installation electrical power and consumption efficiently, and reduce petroleum demand, carbon “bootprint,” and cost.

SPIDERS Design Process

Conceptual Design

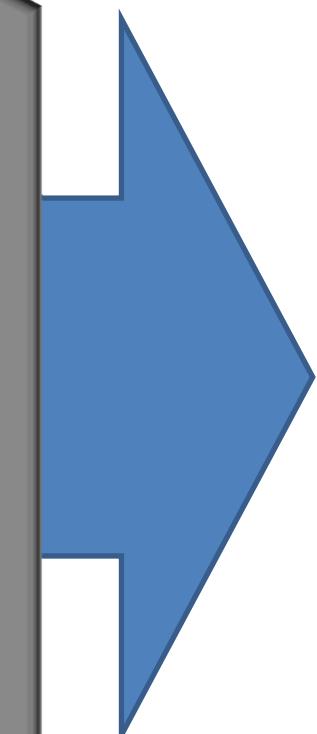
- Site Coordination and Data Collection
- System Characterization
 - Mission
 - Electrical System
 - Energy Resources
 - Network Infrastructure
- Model Setup

Preliminary Design

- Modeling and Simulation
 - Load Flow
 - Grid Dynamics
 - Performance and Reliability
- Initial Microgrid Design
- Controls and Networking Design Analysis
- ESM Components

Detailed Design

- Controls and Protection Design
- Cyber Security Design and Verification
- ESM Architecture and Performance Analysis
 - Design Iteration
- Final Microgrid Design



SPIDERS Cyber Security

- ▶ The SPIDERS JCTD is the "the pioneer in the area of cyber defense of smart microgrids"
- ▶ "Virtual Secure Enclave" active protective strategy for supervisory control and data acquisition control systems.
- ▶ Active cyber protection intrusion detection and design protects system status/operational data from agents seeking to collect, modify, or manipulate the system.



SPIDERS Management Team

- ▶ Technical Manager – US Army Engineering Research Development Center – Construction Engineering Research Laboratory (ERDC-CERL)
- ▶ Operational Manager – PACOM Innovation and Experimentation (**J81**) Energy
- ▶ Transition Manager – Naval Facilities Command (NAVFAC)



Questions?



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